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THE PLANT DISEASE REPORTER

Issued By

Division of Mycology and Disease Survey

Supplement 79

Relation Of Stinking Smut Of Wheat In The Field To Smuttiness Of Threshed Grain

June 1, 1931

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE

RELATION OF STINKING SMUT OF WHEAT IN THE FIELD TO SMUTTINESS OF THRESHED GRAIN

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Plant Disease Reporter
Supplement 79

June 1, 1931

In controlling stinking smut or bunt of wheat, there has frequently been expressed the need for knowing how much smut in the field it takes to cause the threshed grain to grade smutty. Will one per cent affected heads in the field make the grain take a smut discount when sold, or are the limits higher or lower than that amount? The approximate minimum percentage of smut that can be allowed in the field without causing the grain to grade smutty should be known. With this knowledge a farmer could plan to reduce smut by seed treatment, and otherwise, to the point where no discount would be suffered. This information would be helpful to those who have slightly smutty wheat as shown by field counts and who want to remove enough smut during threshing or by means of grain cleaners to reduce the number of smut balls to a point at which the wheat would not grade smutty. It would also be helpful in determining losses from stinking smut.

It is realized that there are several factors which will cause variations and will upset calculations when trying to obtain figures of this kind. For instance, the weather at threshing time will make a difference. Under dry weather conditions and with dry wheat a larger proportion of smut balls will be blown out with the straw than under moist or wet weather conditions. The maturity and variety of grain will cause variations but perhaps the most important factor is the efficiency of threshing machines in removing smut, there being a great deal of variation in different machines.

The Handbook of Official Grain Standards published by the United States Department of Agriculture defines smutty wheat as follows:

> "Smutty wheat shall be all wheat which has an unmistakable odor of smut, or which contains spores, balls or portions of balls, of smut in excess of a quantity equal to two balls of average size in 50 grams of wheat."

It will be noted therefore, that anything in excess of a quantity equal to two smut balls in 50 grams of wheat is enough to make wheat grade smutty.

By making numerous counts of the number of kernels in different sized heads of wheat and by weighing kernels and smut balls, Messrs. R. W. Leukel and J. H. Martin of the Division of Cereal Crops and Diseases, have found that if all of the smut balls remain in the threshed grain, none being removed during threshing process, the number of smut balls in 50 grams of threshed grain would vary all the way from 13 to 50 when there was one per cent affected heads in the field. Theoretically, then, it would be necessary to reduce smut in the field to 0.16 or 0.04 per cent smutted heads in order to obtain two wheat smut balls or less in 50 grams. Practically, however, this is not the case as a great many of the smut balls are blown and screened out during threshing.

During the summer of 1930 a survey was made in 704 fields of spring and durum wheat in Minnesota, North Dakota, South Dakota, and Montana. The growers were consulted regarding their seed treatment practices. The fields were examined and percentages of smut affected heads determined in each. The method used in counting and determining the percentages in the field was to measure off a yeard of drill row and count the smutted and healthy heads in that yard. This was repeated in 10 different parts of the field and the average number of smutted heads determined. The results of this survey have been published in United States Bureau of Plant Industry Plant Disease Reporter Supplement 77, entitled, "Why So Much Smut in Spring Wheat?"

At the conclusion of the survey it was suggested by H. R. Sumner of the Northwest Crop Improvement Association, and by others, that advantage be taken of the opportunity offered to secure samples of threshed grain from these fields in which counts had been made, to have them officially graded as to smut, and to make comparisons between smut in the field and the number of smut balls in the threshed grain from those fields. Consequently, in December, 1930, letters were written to 165 growers, in three States, Minnesota, North and South Dakota, in whose fields smut had been found. In selecting these growers care was taken to see that the list included those who had smutty wheat ranging all the way from 0.1 per cent to as high as 30 per cent or more. The names were grouped according to percentages of smut as shown by field counts. In the first group the percentage of smut ranged from 0.1 to 0.5 per cent and the number of farmers written to were 18. There were nine groups in all as follows:

0.1	-	0.5	per cent	smut	in	field	- 18	farmers
0.6	-	1.0	"	"	"	"	- 10	"
1.1	-	1.5	"	"	"	"	- 17	"
1.6	-	2.0	"	"	"	"	- 14	"
2.1	-	5.0	"	"	"	"	- 35	"
5.1	-	11.0	"	"	"	"	- 32	"
11.1	-	20.0	"	"	"	"	- 26	"
20.1	-	30.0	"	"	"	"	- 6	"
30.1	or	more	"	"	"	"	- 7	"

In writing these farmers each was advised as to the percentage of smut that was found in his field during the summer and a sack was enclosed with the request that a sample of the threshed grain from that particular field be sent in for grading as to smut.

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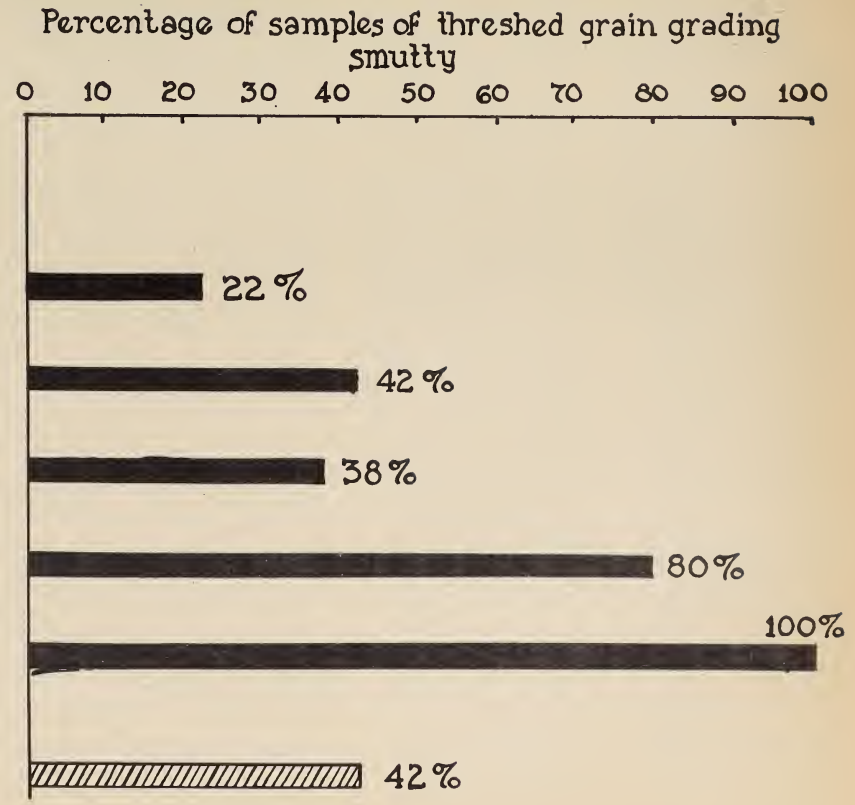
Smut in field (Percentage) smutted heads)	Number grain samples graded
Less than 1	9
1 - 1.9	9
2 - 3.9	12
4 - 7.9	8
8 - 15.9	10
16 - 48	4
Total & Average	52



Fifty-two samples were received and officially graded as to smut in the Office of Grain Investigations, Bureau of Agricultural Economics. Those who did the grading had no way of knowing how much smut had occurred in the field, the samples being referred to by numbers only. An appraisal of the samples by buyers would have given a better idea of their relative value but their separation into groups depending on their smuttiness, as shown by the amounts of spores, balls or portions of balls, gives a better idea of their actual smut content.

Comparisons were then made between percentages of smut in the field and the smuttiness of the samples submitted. As was to be expected there were numerous discrepancies that can not be explained with certainty. They might have been due to almost any one of a number of factors such as,- the degree to which the farmer's sample was representative of the field that had been inspected; the accuracy of the field determination itself; or the great variation in the efficiency of the threshing and grain-cleaning machines which may have been used.

The 52 samples were first arranged in the order of smuttiness in the field, those having only fractions of one per cent being listed first and those having high percentages last. They were then divided into six groups as shown in Table 1. Referring to this table we note that there are nine samples from fields having less than one per cent smutted heads and that none of them graded smutty. There are nine samples also that had between 1 and 1.9 per cent smutted heads in the field, and 22 per cent, or two out of the nine samples of grain graded smutty. In the 4 to 7.9 per cent group, 38 per cent, or about one-third of the eight samples graded smutty. The conclusion might therefore be drawn that in the case of a field with from 4 to 8 per cent smutted heads the chances for the grain grading smutty are about one out of three. With less than one per cent in the field the chances for the grain to grade smutty are very slight.

When smutty wheat is officially graded the grain inspectors located in the markets on the Pacific Coast designate the degree of smut in the grain in terms of whole and half per cent by weight. An illustration of a grade designation under this system would be "Grade - No. 1 Hard White Wheat, Smut Dockage .5%." Grain inspectors located east of the Rocky Mountains merely grade smutty wheat as "Smutty" without indicating in the grade designation the degree or amount of the smut in the grain. An illustration of grading smutty wheat under this system would be "No. 1 Dark Northern Spring Wheat, Smutty." However, the grain inspectors who apply this system of grading are permitted, when requested to do so by the applicant for inspection, to indicate the degree of smut on the grade certificate under "Remarks", in terms of "Light", "Medium", or "Heavy" smut. An illustration of this system would be "No. 1 Dark Northern Spring Wheat, Smutty" and in the blank provided on the grade certificate for "Remarks" the term "light smut", "medium smut" or "heavy smut" as the case might be. When wheat is sold on the market any given lot of grain will always sell at the best price when it is free from smut, and a discount in price is always exacted when the grain is smutty, the severity of the discount increasing with the increase in the amount

of smut that is present in the wheat. The discount ordinarily amounts to 1 or 2 cents per bushel for slightly smutty wheat and sometimes to as high as 20 cents and more per bushel for heavily smutted grain. Discounts in price for light and medium smutty wheat commonly range from 2 to 10 cents per bushel.

In order to make the opposite kind of correlation from that in table 1, the results of the grading of the 52 samples were arranged according to the number of smut balls found in 50 grams of grain and they were then divided into five groups,- clean, not smutty, light smutty, medium smutty, and heavy smutty. Results of this correlation are shown in table 2. From this it will be seen that 14 samples which had no smut balls in the threshed grain showed a range from 0.2 to 4 per cent smutted heads in the field and an average of 1.5 per cent. On the average the more smut balls that were found in the grain the higher the average of smutted heads in the field. An exception will be noted in the 5 to 10 per cent or "medium smutty" class where there was an average of 14.5 per cent in the field. The reason for this high amount is that in this group is included the field that showed the highest smut count, namely, 48 per cent smutted heads. When that field is omitted the average for this group is 8 per cent smutted heads in the field. This table gives an idea of the amount of smut in the field corresponding to different degrees of smuttiness of the threshed grain.

Table 2. Relation between grade of threshed wheat as to smut and percentage of affected heads in the field.

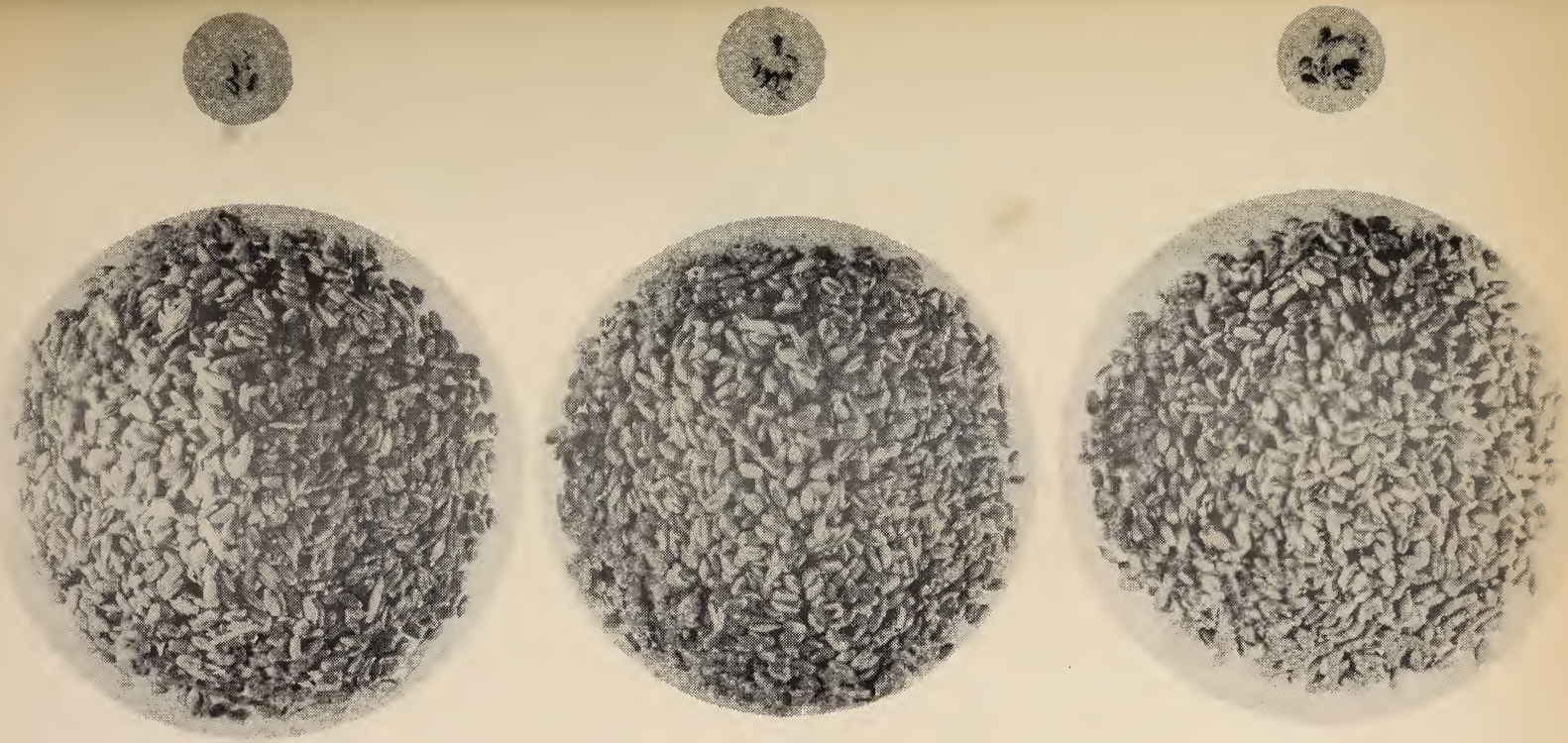
Number of smut balls in 50 grams of grain.	No. field samples graded	Percentage of smutted heads in field. Individual field counts	Average
None (clean)	14	0.2, 0.3, 0.5, 0.5, 0.7, 0.8, 1.3, 1.5, 1.5, 2.0, 2.3, 2.8, 3.0, 4.0	1.5
2 or less (not smutty)	16	0.1, 0.5, 0.5, 1.2, 1.7, 1.8, 1.9, 2.5, 3.1, 3.4, 5.0, 5.0, 6.1, 6.4, 9.5, 11.3	3.8
2 to 5 (light smutty)	5	2.0, 2.5, 4.8, 10.7, 13.0	6.6
5 to 10 (medium smutty)	6	1.0, 3.0, 6.9, 8.0, 20.1, 48.0	14.5
More than 10 (heavy smutty)	11	1.3, 3.5, 3.6, 6.8, 8.1, 8.2, 12.0, 13.0, 14.0, 16.2, 42.7	11.8

On the basis of these samples it might be assumed that "light" smut is equivalent to a field loss of about 6 per cent, "medium" smut means a field loss of about 8 per cent, and "heavy" smut a field loss of 12 per cent or more. Before any definite correlations of this kind can be made, however, it will be necessary to get many more field records and samples, from widely separated parts of the country and under a variety of conditions. The work here reported is only a beginning. It is hoped that others will accumulate data along similar lines and that some time all the results can be brought together for summarizing.

In spring wheat areas of both the United States and Canada, it has been repeatedly observed during the last few years that durum wheat is on the average smuttier than hard red spring varieties. In the case of these samples therefore it was thought that it might be interesting to classify them by types of wheat. This has been done in Table 3, and from this it will be seen that of the 33 samples of hard red spring varieties, 36 per cent were found to be smutty when graded, and of the 19 durum varieties, 53 per cent, or more than half, were smutty. It will be noted also that a larger proportion of the durum than of the hard red spring wheat showed heavy smut.

Table 3. Degrees of smuttiness of hard red spring wheat and durum compared.

Kind of Wheat	No. of samples graded	Percentage of samples grading: Not smutty	Light smutty	Medium smutty	Heavy smutty	Total smutty
All Hard Red Spring Varieties	33	64	6	12	18	36
All Durum Varities	19	47	16	11	26	53
Totals and Averages	52	58	10	11	21	42



A B C

Plate 1. Piles of three 50 gram samples of smutty Marquis wheat with smut balls separated from each.

A. Light smut (4 smut balls)
4.8 per cent smutted heads in the field
B. Medium smut (6.5 smut balls)
6.9 per cent smutted heads in the field
C. Heavy smut (12 smut balls)
13 per cent smutted heads in the field